

REMARKS

Applicant concurrently files herewith an excess claim fee for six (6) additional dependent claims.

Claims 1-27 are all the claims presently pending in the application, stand rejected on prior art grounds. New claims 22-27 have been added to more particularly define the invention.

Claim 1 stands rejected under 35 U.S.C. § 102(e) as being anticipated by Chen et al. (U.S. Patent No. 6,218,200 B1). Claims 2-21 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen, et al. in view of Minami, et al. (U.S. Patent No. 6,368,980 B1).

Both Chen, et al. and Minami, et al. can be removed by filing a verified translation of the priority document since the priority document of the present date has an effective date of July 28, 1999, whereas Chen, et al. and Minami, et al. have an effective date for prior art purposes of December 13, 1999, and July 14, 2000, respectively.

However, both Chen and Minami are clearly deficient on their face and fail to teach or suggest the claimed invention. Thus, these rejections are respectfully traversed in view of the following discussion.

It is noted that the amendments are made only to more completely define the invention and not for distinguishing the invention over the prior art, for narrowing the scope of the claims, or for any reason related to a statutory requirement for patentability.

It is further noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

I. THE CLAIMED INVENTION

Applicant's invention, as disclosed and claimed, for example by claim 1, is directed to an overlay mark.

The overlay mark includes a mark pattern formed by engraving at least one of a groove and an indent in a prescribed position on a layer where a circuit pattern is formed, and a grooved pattern that surrounds the mark pattern so as to protect the mark pattern from being deformed by thermal expansion or contraction of the layer. (See Page 8, lines 5-11; and Figures 1-4).

Similarly, claims 2 and 9 are directed to an overlay mark used for measuring the overlay accuracy in forming a second circuit pattern over a first circuit pattern.

The overlay mark includes a first lower-layer pattern formed by engraving at least one of a groove and an indent in a prescribed position on a first layer where the first circuit pattern is formed, an upper layer pattern formed in a prescribed position on a second layer where the second circuit pattern is to be formed, and a second-layer pattern that is formed by engraving, on the first layer, a frame-shaped groove to surround the first lower-layer pattern, and is not used for measuring the overlay accuracy. (See page 12, lines 10-20).

Conventional art depicts an overlay mark with a mark pattern, i.e., a first lower-layer pattern, but without a grooved pattern, i.e., a second lower-layer pattern. However, the conventional art tends to "undergo non-uniform deformation due to [the] difference in the extent of expansion or contraction resulting from this variation in structural environment," and thus, "the accuracy of the measurement for the overlay accuracy is lowered." (See Page 6, lines 8-20; Page 7, lines 9-25; and Figures 12-17).

An aspect is a grooved pattern that surrounds the mark pattern, which protects the mark pattern from being deformed by thermal expansion or contraction of the layer due to

deformation of the grooved pattern, i.e., the second lower-layer pattern. (See Page 8, lines 5-11; Page 13, lines 1-27; Page 16, lines 4-16; and Figures 1-11).

As a result of this invention, the resultant structure provides an overlay mark with a relatively uniform structural environment around the marked pattern, i.e., the first lower-layer pattern, which permits the formation of “a multi-layered circuit pattern with a high accuracy and a high yield in production, even in the formation of a minute and densely-spaced circuit pattern. (See Page 8, lines 1-5).

II. THE PRIOR ART REJECTIONS

A. The § 102(e) Rejection Based on Chen, et al.

Chen, et al. (Chen) fails to teach or suggest the features of independent claim 1, including a grooved pattern that surrounds the mark pattern so as to protect the mark pattern from being deformed by thermal expansion or contraction of the layer. (See Page 8, lines 5-11; and Figures 1-4).

Chen teaches a multi-layer registration control for photolithography process where Figure 2B only teaches a conventional overlay mark with a mark pattern but without a grooved pattern. In particular, the box registration pattern is printed on the first layer and a “second layer is deposited or grown on the first layer,.... and “a second box registration pattern is printed at the same time that a second circuit pattern is printed on the second layer.” (See Chen at Abstract; Column 2, lines 61-Column 3, line 15). Accordingly, Chen only discloses a single groove between the box registration pattern and the second box registration pattern with a single pattern section whereas Applicant’s invention discloses two pattern sections with two grooves. (See Page 6, lines 8-20; Page 7, lines 9-25; and Figures 12-17). Accordingly, Chen’s conventional overlay mark does not include any grooved

pattern, let alone, a grooved pattern that surrounds the box registration pattern. Indeed, Chen is focused on providing a multi-level registration control systems for a photolithography process using an integrated circuit, which prints first, second and third layers on a wafer, to improve registration control for photolithography processes not to protect the mark pattern from being deformed by thermal expansion or contraction of the layer by deformation of the grooved pattern, i.e., the second lower-layer pattern. (See Chen at Abstract; Column 1, lines 5-10 and 40-46. Thus, Chen does not teach, disclose or suggest including a grooved pattern that surrounds the mark pattern so as to protect the mark pattern from being deformed by thermal expansion or contraction of the layer as disclosed in Applicant's invention. (See Application, Page 2, lines 1-23; and Figure 4).

Consequently, the conventional Chen structure may likely “undergo non-uniform deformation due to [the] difference in the extent of expansion or contraction resulting from this variation in structural environment,” and thus, “the accuracy of the measurement for the overlay accuracy is lowered.” (See Page 6, lines 8-20; Page 7, lines 9-25; and Figures 12-17). Accordingly, Chen only discloses a conventional overlay mark having a single pattern and related groove.

Thus, Chen does not teach, suggest or disclose including a grooved pattern that surrounds the mark pattern so as to protect the mark pattern from being deformed by thermal expansion or contraction of the layer, as in claim 1.

B. The § 103(a) Rejection Based on Chen in view of Minami, et al.

First, as indicated above, both Chen and Minami, et al. (“Minami”) can be removed by filing a verified translation of the priority document since the underlying priority document has a date of July 28, 1999, whereas Chen and Minami have an effective date for prior art

purposes of December 13, 1999, and July 14, 2000, respectively.

Regarding the rejection of claims 2-21, the Examiner's urged combination of Chen and Minami likewise is deficient in teaching or suggesting the invention.

Minami fails to make up for the deficiencies of Chen.

First, the references, separately, or in combination, fail to teach, disclose or provide a reason or motivation for being combined. In particular, Chen pertains to a multi-layer registration control system to improve registration control for photolithography processes as indicated above.

By contrast, Minami does not have the same aim as Chen.

Minami discloses a resist mark for measuring the accuracy of an overlay of a photomask disposed on a wafer with a first measurement mark formed the substrate, an intermediate layer formed on the first measurement mark, a second measurement mark formed on the intermediate layer and a third measurement mark. Minami is specifically directed to "a resist mark having measurement marks which are not affected by the thermal flow phenomenon and which improve the alignment accuracy." (See Minami at Abstract; Column 1, lines 15-22; and Column 2, lines 10-35).

Nothing within Minami, which relates to improving the alignment accuracy of a resist mark of an overlay, suggests a multi-layer registration control system with an integrated circuit and a feedback controller to improve registration control for photolithography processes as disclosed in Chen. Thus, Chen teaches away from being combined with another invention for example Minami.

Therefore, one of ordinary skill in the art would not have combined these references, absent hindsight. It is clear that the Examiner has simply read Applicant's specification and conducted a keyword search to yield Chen and Minami. Further, the Examiner provides no

motivation or reason to combine other than to assert that it would have been obvious to one having ordinary skill in the art, “to utilize a second lower-layer pattern, in the shape of a polygonal frame, as shown by Minami in combination with the box pattern disclosed by Chen, ..., for the purpose of providing a resist mark having measurement marks which are not affected by the thermal flow phenomenon an which improve alignment accuracy .” Such an assertion does not take into account the distinct structural differences of the two invention as indicated above, and further discussed below. Thus, the Examiner’s assertion attempts to solve a potential problem which does not ever exist with either Chen or Minami, and this assertion is further proof of the Examiner’s use of impermissible hindsight.

Secondly, even if combined, the references do not teach or suggest the features of independent claim 2, and similar claim 9, including a second lower-layer pattern that is formed by engraving, on the first layer, a frame-shaped groove to surround the first lower-layer pattern, and is not used for measuring the overlay accuracy.

Chen, as discussed above, does not include this feature. Further, the Examiner admits that Chen also does not teach or suggest that the second lower-layer pattern is in the shape of a polygonal frame as indicated in claims 4 and 10. (See Office Action, Page 5, lines 1-3).

Minami does not make up for the deficiencies of Chen discussed above. Indeed, Minami discloses a resist mark for measuring the accuracy of an overlay of a photomask disposed on a wafer with a first measurement mark formed the substrate, an intermediate layer formed on the first measurement mark, a second measurement mark formed on the intermediate layer and a third measurement mark, as described above. (See Minami at Abstract; Column 2, lines 17-35).

Further, Figures 3A and 3B of Minami includes a second measurement mark situated between a groove and a second lower-layer pattern where “the second measurement mark has

a width which is short enough not to be influenced by a deformation caused by the thermal flow phenomenon” because “no stress is applied to the second measurement mark.”

“Accordingly, ..., the dislocation of the second photomask can be measured accurately using the second measurement pattern, which has a fine edge.” (See Column 3, lines 17-67).

Thus, Minami is specifically directed to “a resist mark having measurement marks which are not affected by the thermal flow phenomenon and which improve the alignment accuracy.” (See Minami at Abstract; Column 1, lines 15-22; and Column 2, lines 10-35). Since Minami has a second measurement mark, which is not stressed by thermal flow, and is used for alignment accuracy, this configuration does not include a second lower-layer pattern that is formed by engraving, on the first layer, a frame-shaped groove to surround the first lower-layer pattern, and is not used for measuring the overlay accuracy, and thus is deformed by thermal stress as disclosed by Applicant’s invention. (See Page 8, lines 5-11; Page 13, lines 1-27; Page 16, lines 4-16; and Figures 1-11).

Minami, however, does not teach, disclose or suggest, including a second lower-layer pattern that is formed by engraving, on the first layer, a frame-shaped groove to surround the first lower-layer pattern, and is not used for measuring the overlay accuracy. Consequently, Minami also does not teach, suggest or disclose Applicant’s invention.

Accordingly, Applicant traverses the assertion in the Office action that Minami teaches or suggests Applicant’s invention. (See Office Action, Page 5, lines 4-10).

Therefore, neither Chen nor Minami teaches or suggests a second lower-layer pattern that is formed by engraving, on the first layer, a frame-shaped groove to surround the first lower-layer pattern, and is not used for measuring the overlay accuracy as recited in claim 2, and similar claim 9. Applicant’s invention provides for an overlay mark with a relatively uniform structural environment around the marked pattern, i.e., the first lower-layer pattern,

which permits the formation of “a multi-layered circuit pattern with a high accuracy and a high yield in production, even in the formation of a minute and densely-spaced circuit pattern.” (See Page 8, lines 1-11; Page 13, lines 1-27; Page 16, lines 4-16; and Figures 1-11).

For at least the reasons outlined above, Applicant respectfully submits that neither the Chen nor Minami teach or suggest all of the features of independent claims 2 and 9, and related dependent claims, 3-10 and 11-21. These dependent claims are patentable not only by virtue of their dependency from their respective independent claims, but also by the additional limitations they recite.

For the reasons stated above, the claimed invention, and the invention as cited, should be fully patentable over the cited references.

IV. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 1-27, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

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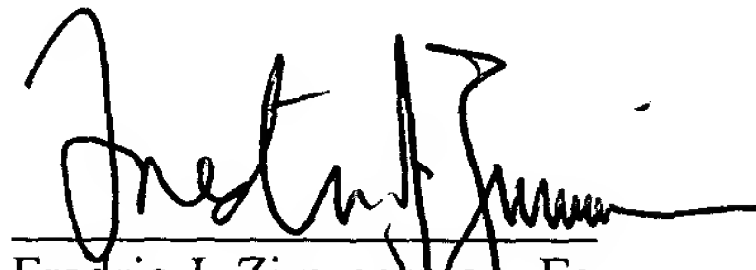
The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: _____

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